

AMENDMENT UNDER 37 C.F.R. § 1.111

Application Number: 10/795,977

Attorney Docket Number: Q80411

AMENDMENTS TO THE CLAIMS

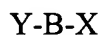
This listing of claims will replace all prior versions and listings of claims in the application:

LISTING OF CLAIMS:

Claims 1-21. (cancelled).

22. (previously presented): A cross-linked polymer formed by

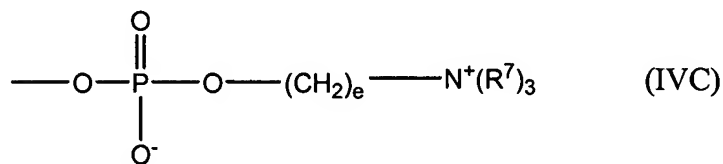
- a) radical polymerisation of radical polymerisable monomers including
- i) a zwitterionic monomer having the formula:



wherein

B is a straight or branched alkylene, oxaalkylene or oligo-oxaalkylene chain optionally containing one or more fluorine atoms up to and including perfluorinated chains, or if X contains a carbon-carbon chain between B and the centre of permanent position charge or if Y contains a terminal carbon atom bonded to B, a valence bond;

X is a zwitterionic group selected from groups, IVC, IVD and IVF in which group IVC has the formula



where

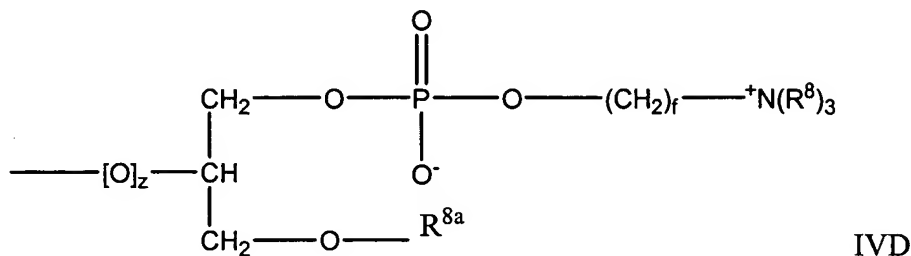
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the groups R^7 are the same or different and each is hydrogen or C_{1-4} alkyl, and e is from 1 to 4;

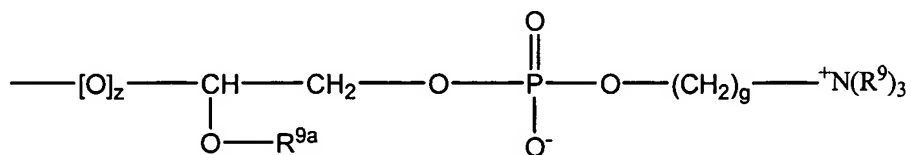
group IVD has the formula



wherein

the groups R^8 are the same or different and each is hydrogen or C_{1-4} alkyl, R^{8a} is hydrogen or a group $\text{---C(O)B}^1\text{R}^{8b}$ wherein R^{8b} is hydrogen or methyl, B^1 is a valence bond or straight or branched alkylene, oxaalkylene or olig-oxaalkylene group, and f is from 1 to 4; and if B is other than a valence bond z is 1 and if b is a valence bond z is 0, if X is directly bonded to an oxygen or nitrogen atom and otherwise z is 1;

group IVE has the formula



wherein

the groups R^9 are the same or different and each is hydrogen or $C_1\text{--}C_4$ alkyl, R^{9a} is hydrogen or a group $\text{---C(O)B}^2\text{R}^{9b}$, wherein R^{9b} is hydrogen or methyl, B^2 is a valence bond or a straight or branched alkylene, oxaalkylene or olig-oxaalkylene or olig-oxaalkylene group, and g is from 1 to 4; and

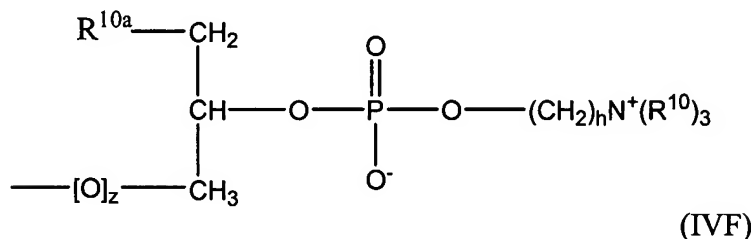
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if B is other than a valence bond z is 1 and if B is a valence bond z is 0 if X is directly bonded to an oxygen or nitrogen atom and otherwise z is 1; and

group IVF has the formula

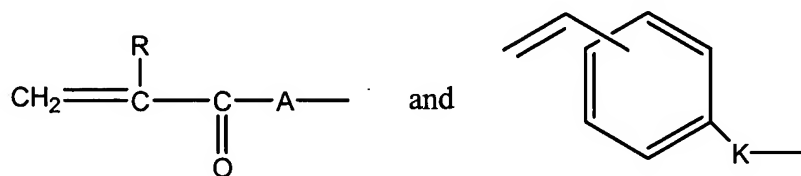


wherein

the groups R^{10} are the same or different and each is hydrogen or C_{1-4} alkyl, R^{10a} is hydrogen or a group $-\text{C}(\text{O})\text{B}^3\text{R}^{10b}$ wherein R^{10b} is hydrogen or methyl, B^3 is a valence bond or a straight or branched alkylene, oxaalkylene or oligo-oxaalkylene group, and h is from 1 to 4; and

if B is other than a valence bond z is 1 and if B is a valence bond z is 0 if X is directly bonded to the oxygen or nitrogen and otherwise z is 1 and;

Y is an ethylenically unsaturated polymerisable group selected from



wherein:

R is hydrogen or a $\text{C}_1\text{-C}_4$ alkyl group;

A is $-\text{O}-$ or $-\text{NR}^1$ where R^1 is hydrogen or a $\text{C}_1\text{-C}_4$ alkyl group or R^1 is $-\text{B-X}$ where B and X are as defined above; and

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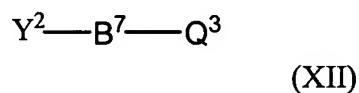
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K^2 is a group - $(CH_2)_pOC(O)-$, $-(CH_2)_pC(O)O-$, $-(CH_2)_pOC(O)O-$, $-(CH_2)_pNR^{2-}$, -
 $(CH_2)_pNR^{2-}C(O)-$, $-(CH_2)_pC(O)NR^{2-}$, $-(CH_2)_pNR^{2-}C(O)-$, $-(CH_2)_pOC(O)NR^{2-}$, -
 $(CH_2)_pNR^{2-}C(O)NR^{2-}$, (in which the groups R^2 are the same or different)

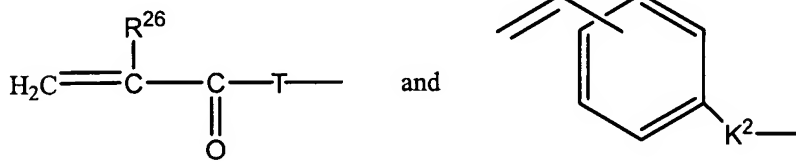
$-(CH_2)_pO$, $-(CH_2)_pSO_3-$, or, optionally in combination with B, a valence bond and p is
from 1 to 12 and R^2 is hydrogen or a C_1 - C_4 alkyl group and

ii) a monomer having a reactive group of the formula general formula (XII)



where

Y^2 is an ethylenically unsaturated polymerisable group selected from



where

R^{26} is hydrogen or C_1 - C_4 alkyl;

T is $-O-$ or NR^{27} or , wherein R^{27} is hydrogen or a C_1 - C_4 alkyl group or R^{27} is a $-B^7Q_3$
group ;

B^7 is a valence bond a straight or branched alkylene oxaalkylene or oligo-oxaalkylene
group;

K^2 is a group - $(CH_2)_qOC(O)-$, $-(CH_2)_qC(O)O-$, $-(CH_2)_qOC(O)O-$, $-(CH_2)_qNR^{20-}$, -
 $(CH_2)_qNR^{20-}C(O)O-$, $-(CH_2)_qC(O)NR^{20-}$, $-(CH_2)_qNR^{20-}C(O)O-$, $-(CH_2)_qOC(O)NR^{20-}$, -
 $(CH_2)_qNR^{20-}C(O)NR^{20-}$ (in which the groups R^{20} are the same or different), $-(CH_2)_qO-$ or -

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$(\text{CH}_2)_q\text{SO}_3^-$ or , or a valence bond and q is from 1 to 12 and R^{20} is hydrogen or $\text{C}_1\text{-C}_4$ alkyl group; and

Q^3 is a reactive group selected from the groups consisting of aldehyde groups; silane and siloxane groups containing one or more substituents selected from halogen atoms and C_{1-4} -alkoxy groups; hydroxyl; amino; carboxyl; epoxy; $-\text{CHOHCH}_2\text{Hal}$ (in which Hal is selected from chlorine, bromine and iodine atoms); succinimido; tosylate; triflate; imidazole carbonylamino; optionally substituted triazine groups; cinnamyl; ethylenically and acetylenically unsaturated groups; acetoacetoxy; methylol; and chloroalkylsulphone groups; and

b) cross-linking the polymer by forming cross-linkages between groups Q^3 derived from the said monomer having a reactive group.

23. (previously presented): A polymer according to claim 22 in which Q^3 is selected from the group consisting of aldehyde, silane and siloxane groups containing one or more substituents selected from halogen atoms and C_{1-4} alkoxy groups, amino, epoxy, $\text{CHOHCH}_2\text{Hal}$ (in which Hal is halogen), succinimido, tosylate, triflate, imidazolecarbonyl amino and optionally substituted triazine groups.

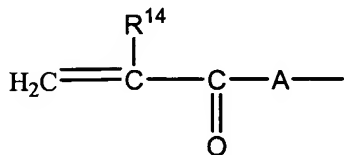
24. (previously presented): A polymer according to claim 22 in which the group Q^3 is selected from the group consisting of amino, acetylenically unsaturated hydrocarbon groups, 3-chloro-2-hydroxypropyl and 3-trimethoxy silyl propyl.

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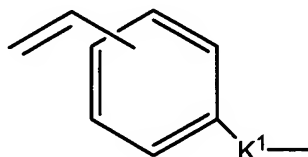
26. (previously presented): A polymer according to claim 22 in which said radical polymerisable monomers include a comonomer having the general formula (VI)



Y¹ is an ethylenically unsaturated polymerisable group selected from



and



(CH₂)_lSO₃, a valence bond and l is from 1 to 12 and R¹⁶ is hydrogen or a C₁-C₄ alkyl group; and

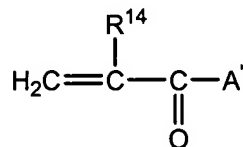
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Q is selected from the group consisting of straight and branched alkyl, alkoxyalkyl and (oligo-alkoxy)alkyl groups containing 6 to 24 carbon atom, any of which groups is unsubstituted or substituted by one or more fluorine atoms and optionally contains one or more carbon-carbon double or triple bonds; and siloxane groups $(\text{CR}^{16a})_{qq}(\text{SiR}^{16b})_2(\text{OSiR}^{16b})_{pp}\text{R}^{16b}$ in which each group R^{16a} is the same or different and is selected from the group consisting of hydrogen, alkyl groups of 1 to 4 carbon atoms and aralkyl groups, each group R^{16b} is alkyl of 1 to 4 carbon atoms, qq is from 1 to 6 and pp is from 0 to 49.

27. (previously presented): A polymer according to claim 26 in which Y^1 is



in which

R^{14} is methyl;

A' is -O-; and

Q is an alkyl group of the formula $-(\text{CR}^{17})_m\text{CR}^{17}$ wherein the groups $-(\text{CR}^{17})-$ are the same or different and in each group $-(\text{CR}^{17})-$ the groups R^{17} are the same or different and each group R^{17} is selected from the group consisting of hydrogen, C_{1-4} -alkyl and -fluoroalkyl and fluorine and m is in the range 5 to 23.

28. (previously presented): A polymer according to claim 27 in which the said comonomer is selected from the group consisting of n-dodecyl methacrylate, octadecyl

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methacrylate, hexadecylmethacrylate, 1H, 1H, 2H, 2H-heptafluorodecylmethacrylate, p-octyl styrene, p-dodecyl styrene and monomethacryloyloxypropyl terminated siloxanes.

29. (previously presented): A polymer according to claim 28 in which the said comonomer is dodecyl methacrylate.

30. (previously presented): A polymer according to claim 22 in which the said radical polymerisable monomers include a diluent monomer selected from the group consisting of C₁₋₄-alkyl(alk)acrylates, N, N-dialkylamino alkyl(alk)acrylates containing 1 to 4 carbon atoms in each N-alkyl group and 1 to 4 carbon atoms in the alkylene group, C₁₋₄ alkyl(alk)acrylamide, hydroxy C₁₋₄-alkyl(alk)acrylate, N-vinyl lactam having 5-7 atoms in the lactam ring, styrene, derivatives of styrene having ring substituents selected from C₁₋₄ alkyl groups and halogen atoms, polyhydroxyl (alk)acrylates, alkenes, butadiene, maleic anhydride and acrylonitrile.

31. (previously presented): A polymer according to claim 30 in which the diluent monomer is selected from hydroxy C₁₋₄-alkyl(alk)acrylates and polyhydroxyl(alk)acrylates.

32. (previously presented): A polymer according to claim 22 in which the said radical polymerisable monomers include at least 5% by weight zwitterionic monomer and at least 0.1% by weight monomer having a reactive group.

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33. (previously presented): A polymer according to claim 22 in which the said radical polymerisable monomers include at least 5% by weight zwitterionic monomer and 0.1% to 20% by weight monomer having a reactive group.

34. (previously presented): A polymer according to claim 30 in which the said radical zwitterionic monomers include at least 5% by weight, at least 0.1% by weight monomer having a reactive group and 5 to 20% by weight diluent monomer.

35. (previously presented): A polymer according to claim 26 in which the said radical polymerisable monomers include at least 5% by weight zwitterionic monomer, at least 0.1% by weight monomer having a reactive group and 5 to 90% by weight of said comonomer.

36. (previously presented): A polymer according to claim 22 in which said cross-linkage is by direct reaction of groups Q^3 with one another.

37. (previously presented): A polymer according to claim 22 in which said cross-linkage is by reaction of groups Q^3 with a reactive bridging molecule.

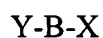
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38. (previously presented): A process in which a cross-linkable polymer is cross-linked by forming cross-linkages between reactive groups Q^5 on the polymer wherein the cross-linkable polymer is formed by

- a) radical polymerisation of radical polymerisable monomers including
 - i) a zwitterionic monomer having the formula:

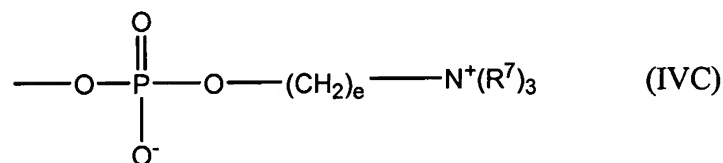


wherein

B is a straight or branched alkylene, oxaalkylene or oligo-oxaalkylene chain optionally containing one or more fluorine atoms up to and including perfluorinated chains, or if X contains a carbon-carbon chain between B and the centre of permanent position charge or if Y contains a terminal carbon atom bonded to B, a valence bond;

X is a zwitterionic group selected from groups, IVC, IVD and IVF in which

group IVC has the formula



where

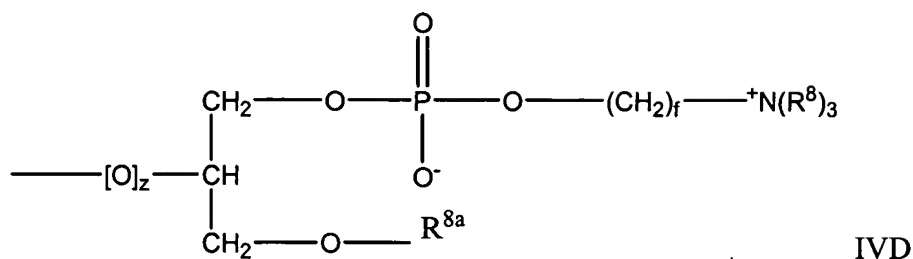
the groups R^7 are the same or different and each is hydrogen or C_{1-4} alkyl, and e is from 1 to 4;

group IVD has the formula

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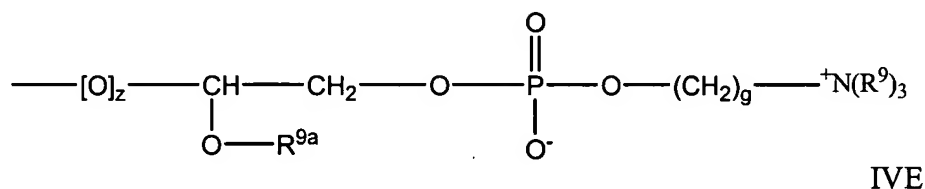
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wherein

the groups R^8 are the same or different and each is hydrogen or C_{1-4} alkyl, R^{8a} is hydrogen or a $\text{---C(O)B}^1\text{R}^{8b}$ group wherein R^{8b} is hydrogen or methyl, B^1 is a valence bond or straight or branched alkylene, oxaalkylene or olig-oxaalkylene group, and f is from 1 to 4; and if B is other than a valence bond z is 1 and if b is a valence bond z is 0, if X is directly bonded to an oxygen or nitrogen atom and otherwise z is 1;

group IVE has the formula



wherein

the groups R^9 are the same or different and each is hydrogen or $\text{C}_1\text{--C}_4$ alkyl, R^{9a} is hydrogen or a $\text{---C(O)B}^2\text{R}^{9b}$ group, wherein R^{9b} is hydrogen or methyl, B^2 is a valence bond or a straight or branched alkylene, oxaalkylene or olig-oxaalkylene or olig-oxaalkylene group, and g is from 1 to 4; and

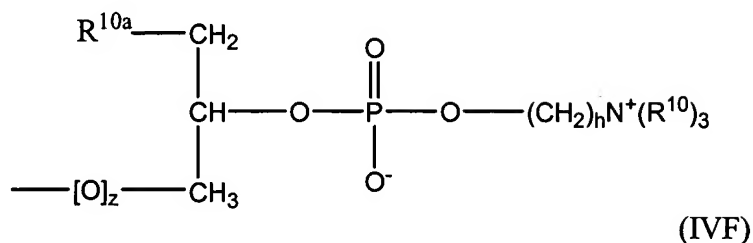
if B is other than a valence bond z is 1 and if B is a valence bond z is 0 if X is directly bonded to an oxygen or nitrogen atom and otherwise z is 1; and

group IVF has the formula

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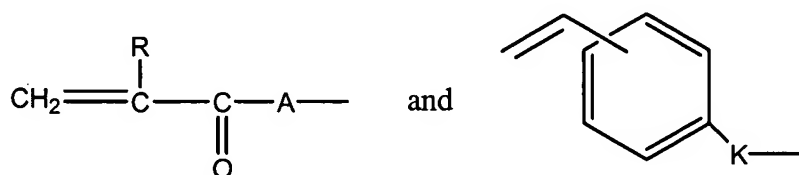


wherein

the groups R^{10} are the same or different and each is hydrogen or C_{1-4} alkyl, R^{10a} is hydrogen or a $-C(O)B^3R^{10b}$ group wherein R^{10b} is hydrogen or methyl, B^3 is a valence bond or a straight or branched alkylene, oxaalkylene or oligo-oxaalkylene group, and h is from 1 to 4; and

if B is other than a valence bond z is 1 and if B is a valence bond z is 0 if X is directly bonded to the oxygen or nitrogen and otherwise z is 1 and;

Y is an ethylenically unsaturated polymerisable group selected from



wherein:

R is hydrogen or a C_1 - C_4 alkyl group;

A is $-O-$ or $-NR^1$ where R^1 is hydrogen or a C_1 - C_4 alkyl group or R^1 is $-B-X$ where B and X are as defined above; and

K^2 is a group $-(CH_2)_pOC(O)-$, $-(CH_2)_pC(O)O-$, $-(CH_2)_pOC(O)O-$, $-(CH_2)_pNR^2-$, $-(CH_2)_pNR^2C(O)-$, $-(CH_2)_pC(O)NR^2-$, $-(CH_2)_pNR^2C(O)-$, $-(CH_2)_pOC(O)NR^2-$, $-(CH_2)_pNR^2C(O)NR^2-$, (in which the groups R^2 are the same or different)

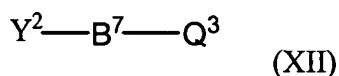
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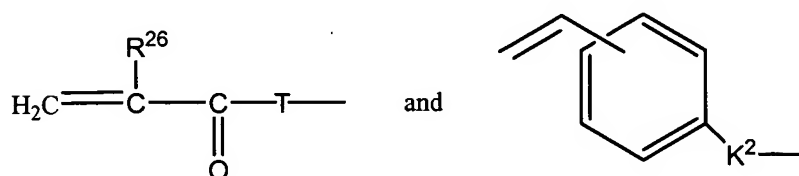
$-(CH_2)_pO$, $-(CH_2)_pSO_3-$, or, optionally in combination with B, a valence bond and p is from 1 to 12 and R^2 is hydrogen or a C_1 - C_4 alkyl group and

ii) a monomer having a reactive group of the formula general formula (XII)



where

Y^2 is an ethylenically unsaturated polymerisable group selected from



where

R^{26} is hydrogen or C_1 - C_4 alkyl;

T is $-O-$ or NR^{27} or , wherein R^{27} is hydrogen or a C_1 - C_4 alkyl group or R^{27} is a $-B^7Q_3$

group ;

B^7 is a valence bond a straight or branched alkylene oxaalkylene or oligo-oxaalkylene

group;

K^2 is a group $-(CH_2)_qOC(O)-$, $-(CH_2)_qC(O)O-$, $-(CH_2)_qOC(O)O-$, $-(CH_2)_qNR^{20}-$, $-(CH_2)_qNR^{20}C(O)O-$, $-(CH_2)_qC(O)NR^{20}-$, $-(CH_2)_qNR^{20}C(O)O-$, $-(CH_2)_qOC(O)NR^{20}-$, $-(CH_2)_qNR^{20}C(O)NR^{20}-$ (in which the groups R^{20} are the same or different), $-(CH_2)_qO-$ or $-(CH_2)_qSO_3-$ or , or a valence bond and q is from 1 to 12 and R^{20} is hydrogen or C_1 - C_4 alkyl group; and

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Q³ is a reactive group selected from the groups consisting of aldehyde groups; silane and siloxane groups containing one or more substituents selected from halogen atoms and C₁₋₄ -alkoxy groups; hydroxyl; amino; carboxyl; epoxy; -CHOHCH₂Hal (in which Hal is selected from chlorine, bromine and iodine atoms); succinimido; tosylate; triflate; imidazole carbonylamino; optionally substituted triazine groups; cinnamyl; ethylenically and acetylenically unsaturated groups; acetoacetoxy; methylol; and chloroalkylsulphone groups.

39. (previously presented): A process according to claim 38 in which Q³ is selected from the group consisting of aldehyde, silane and siloxane groups containing one or more substituents selected from halogen atoms and C₁₋₄ alkoxy groups, amino, epoxy, CHOHCH₂Hal (in which Hal is halogen), succinimido, tosylate, triflate, imidazolecarbonyl amino and optionally substituted triazine groups.

40. (previously presented): A process according to claim 38 in which the group Q³ is selected from the group consisting of amino, acetylenically unsaturated hydrocarbon groups, 3-chloro-2-hydroxypropyl and 3-trimethoxy silyl propyl.

41. (previously presented): A process according to claim 38 in which the said monomer having a reactive group is selected from the group consisting of 2-aminoethylmethacrylate, 7-dodecynmethacrylate, 3-chloro-2-hydroxypropylmethacrylate and 3-(trimethoxysilyl) propylmethacrylate.

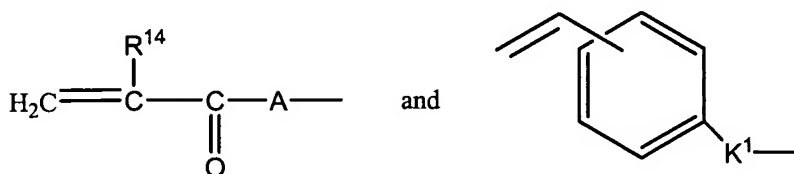
42. (previously presented): A process according claim 38 in which said radical polymerisable monomers include a comonomer having the general formula (VI).

Y^1 -Q

(VI)

where

Y^1 is an ethylenically unsaturated polymerisable group selected from



where

R^{14} is hydrogen or C_1 - C_4 alkyl,

A' is -O- or - NR^{15} - where R^{15} is hydrogen or a C_1 - C_4 alkyl group or R^{15} is a group Q;

K^1 is a group - $(CH_2)_lOC(O)-$, - $(CH_2)_lC(O)O-$, - $(CH_2)_lOC(O)O-$, - $(CH_2)_lNR^{16}-$, - $(CH_2)_lNR^{16}C(O)-$, - $(CH_2)_lC(O)NR^{16}-$, - $(CH_2)_lNR^{16}CH(O)O-$, - $(CH_2)_lOC(O)NR^{16}-$, - $(CH_2)_lNR^{16}C(O)NR^{16}-$ (in which the groups R^{16} are the same or different), - $(CH_2)_lO-$, - $(CH_2)_lSO_3$, a valence bond and l is from 1 to 12 and R^{16} is hydrogen or a C_1 - C_4 alkyl group; and

Q is selected from the group consisting of straight and branched alkyl, alkoxyalkyl and (oligo-alkoxy)alkyl groups containing 6 to 24 carbon atom, any of which groups is unsubstituted or substituted by one or more fluorine atoms and optionally contains one or more carbon-carbon double or triple bonds; and siloxane groups $(CR^{16a})_{qq}(SiR^{16b})_2(OSiR^{16b})_{pp}R^{16b}$ in which each group R^{16a} is the same or different and is selected from the group consisting of hydrogen, alkyl

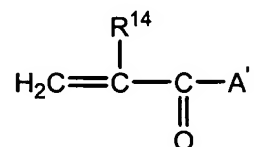
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groups of 1 to 4 carbon atoms and aralkyl groups, each group R^{16b} is alkyl of 1 to 4 carbon atoms, qq is from 1 to 6 and pp is from 0 to 49.

43. (previously presented): A process according claim 38 in which Y^1 is



in which

R^{14} is methyl;

A' is -O-; and

Q is an alkyl group of the formula $-(CR^{17}_2)_mCR^{17}$ wherein the groups $-(CR^{17})-$ are the same or different and in each group $-(CR^{17}_2)-$ the groups R^{17} are the same or different and each group R^{17} is selected from the group consisting of hydrogen, C_{1-4} -alkyl and -fluoroalkyl and fluorine and m is in the range 5 to 23.

44. (previously presented): A process according to claim 43 in which the said comonomer is selected from the group consisting of n-dodecyl methacrylate, octadecyl methacrylate, hexadecylmethacrylate, 1H, 1H, 2H, 2H-heptadecafluorodecylmethacrylate, p-octyl styrene, p-dodecyl styrene and monomethacryloyloxypropyl terminated siloxanes.

45. (previously presented): A process according to claim 44 in which the said comonomer is dodecyl methacrylate.

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46. (previously presented): A process according to claim 38 in which the said radical polymerisable monomers include a diluent monomer selected from the group consisting of C₁₋₄ -alkyl(alk)acrylates, N, N-dialkylamino alkyl(alk)acrylates containing 1 to 4 carbon atoms in each N-alkyl group and 1 to 4 carbon atoms in the alkylene group, C₁₋₄ alkyl(alk)acrylamide, hydroxy C₁₋₄ -alkyl(alk)acrylate, N-vinyl lactam having 5-7 atoms in the lactam ring, styrene, derivatives of styrene having ring substituents selected from C₁₋₄ alkyl groups and halogen atoms, polyhydroxyl (alk)acrylates, alkenes, butadiene, maleic anhydride and acrylonitrile.

47. (previously presented): A process according to claim 46 in which the diluent monomer is selected from hydroxy C₁₋₄ -alkyl(alk)acrylates and polyhydroxyl(alk)acrylates.

48. (previously presented): A process according to claim 38 in which the said radical polymerisable monomers include at least 5% by weight zwitterionic monomer and at least 0.1% by weight monomer having a reactive group.

49. (previously presented): A process according to claim 38 in which the said radical polymerisable monomers include at least 5% by weight zwitterionic monomer and 0.1% to 20% by weight monomer having a reactive group.

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50. (currently amended): A ~~polymer~~process according to claim 46 in which the said radical zwitterionic monomers include at least 5% by weight, at least 0.1% by weight monomer having a reactive group and 5 to 20% by weight diluent monomer

51. (previously presented): A process according to claim 42 in which the said radical polymerisable monomers include at least 5% by weight zwitterionic monomer, at least 0.1% by weight monomer having a reactive group and 5 to 90% by weight of said comonomer.

52. (previously presented): A process according to claim 38 in which said cross-linkage is by direct reaction of groups Q^3 with one another.

53. (previously presented): A process according to claim 38 in which said cross-linkage is by reaction of groups Q^3 with a reactive bridging molecule.

54. (previously presented): A polymer according to claim 22 in which X is said group IVC.

55. (previously presented): A process according to claim 38 in which X is said group IVC.